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RESEARCH ON SEMICONDUCTORS #20

3583

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Electrical Engineering Research Laboratory
Department of Electrical Engineering
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1. PROJECT STATUS AND FUTURE PLANS

1.1 Thin Films of Magnesium on Magnesium Oxide - John Moore

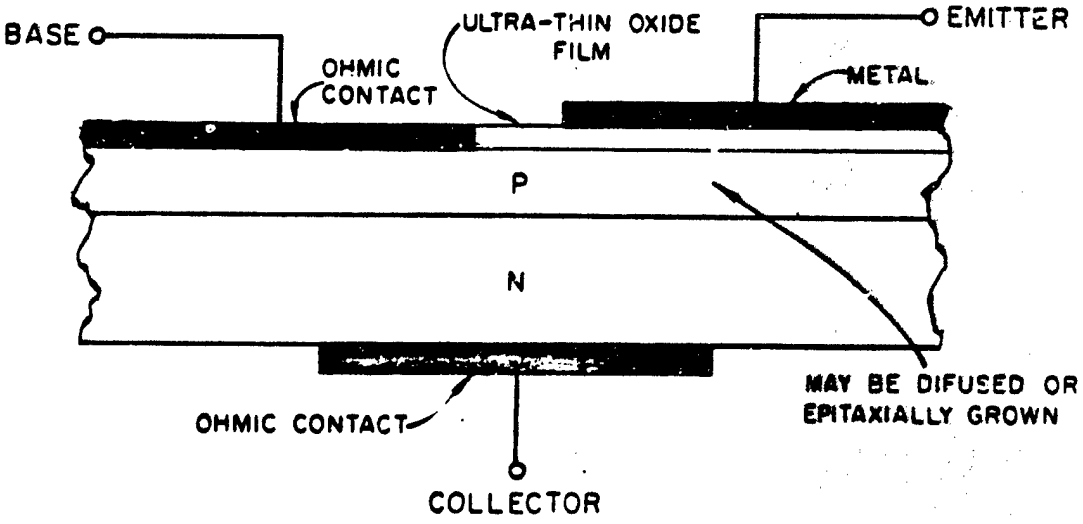
I have deposited magnesium on magnesium oxide crystals at +77°K and obtained the resistance vs. temperature curves from -195°C to -150°C of the magnesium films. Above - 150°C the resistance increases rapidly and irreversibly. The data, though taken with reasonable care, has proven to be too erratic to make anything but qualitative statements about the films.

New tubes have been built with the aim of improving temperature measurements by 1) providing a heat sink for the crystal, and 2) attaching a thermocouple directly to the crystal but insulated from other electrical contacts. In an effort to obtain more geometrically uniform and electrically stable contacts on the crystal, I have used evaporated platinum rather than pointed graphite contacts.

There has also been the problem of tubes cracking at liquid nitrogen temperature. It seems most probable that this problem can be best overcome by a more painstaking application of the glass blowers art rather than by a new tube design. If this is not the case we have several modified designs we can try.

1.2 Tunnel Triode Using Ultra-thin Oxide Film - Henry Pao

The interesting result obtained in using the ultra-thin oxide film as the field effect transistor gate (c.f. Technical Status Report No. 18) led to the belief that the ultra-thin film may be used as the emitter junction of a transistor having the following profile:



One assumed fact was that the thin film has to be grown on top of a fresh-cleaved surface. It is virtually impossible to make a diffused or alloyed layer deep enough to be cleaved. Several ways to get around the cleavage step were tried. One successful run was obtained through careful lapping with a 0.2 μ alumina powder. The surface was then placed under an infrared lamp for half an hour before the metal side is vacuum deposited on. The CD and AC plots of the diodes were rather noisy, but display roughly the same tunneling characteristics. Additional experiments will be tried in the near future. If it is verified, some silicon wafers with P epitaxial on N, obtained from IBM, may be employed to fabricate the above-described tunnel triode. Such a device, as Dr. Bardeen suggested, would be an interesting means to separate and evaluate the tunneling currents, i.e. the electron current from the hole current.

1.3 The Selenium-Tellunum Alloy System

P. Lanyon has left the project as of 1 September 1963 to join the RCA Laboratories in Princeton, New Jersey. He will write up for publication the results of his two year experimental program while at his new position.

2. PERSONNEL

Name	Position	Percent of Time
Dr. John Bardeen	Professor	no cost to project
Paul Handler	Associate Professor	50% 9/16/63 - 6/15/64
Hubert P. D. Lanyon	Visiting Research Associate	100% 15/6/63 - 31/8/63
John S. Moore	Research Assistant	50% 9/1/63 - 8/31/64
Henry Pao	Research Assistant	50% 9/16/63 - 6/15/64
Joan D. McCormick	Clerk-Typist II	25% 7/1/63 - 6/30/64
Claude Michel Penchina	Research Associate	100% 9/1/63 - 8/31/64
Susan Torrico	Technical Draftsman Illustrator I	100% 7/1/63 - 6/30/64
Merril Watson	Glassblower I	100% 8/1/63 - 6/30/64